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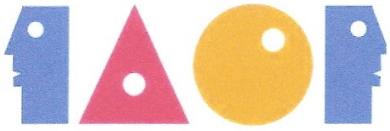

PERFORMANCE EVALUATION AND COUNTERMEASURES OF URBAN LAND USE IN WESTERN CHINA UNDER THE BACKGROUND OF REGIONAL COORDINATED DEVELOPMENT: A CASE STUDY OF HECHI CITY, GUANGXI

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Abstract

Regional coordinated development is the second major opportunity for the development of the cities in western China since the implementation of the China Western Development Program. In recent years, under the influence of regional coordinated development, the rapid development of urban areas in western China and the level of urbanization have been improved rapidly, but the contradiction between people and land, the contradiction between urban land resources and urban expansion and economic development has gradually intensified. Therefore, scientifically grasping and analyzing the utility information of urban land use is of great significance for promoting the efficient use of land and sustainable development of the city's society and economics. We selected Hechi City, which was seen as the important portal of Southwest China to the ASEAN International Passage, as the study area. The study constructed an evaluation index system which was based on land use input level, utilization structure and degree, utilization benefit and ecological sustainability and used the comprehensive index method to assess urban land use performance of Hechi City. The results showed that the comprehensive performance index kept an upward developing trend in fluctuations during 2010 to 2015. The performance index of utilization bene-

fit and ecological sustainability had been increasing continuously, while that of land use input level increased insignificantly. Besides, the performance index of utilization structure and degree fluctuated and its effect to the comprehensive performance index is remarkable, so that it is important for the city to optimize land structure and improving land use efficiency. Based on the research results, four countermeasures were put forward to address the problem in optimizing land structure and sustainable utilization of land resources for Hechi City.

Key words: Urban land use; Performance evaluation; Target index system; Hechi City

Introduction

Coordinated regional development provides the western region of China with the most promising opportunity for further development since the implementation of the China Western Development Program. In recent years, coordinated regional development has facilitated the rapid growth of cities in the western region as well as fast improvement in terms of urbanization. However, this has resulted in conflicts between stakeholders' interests and land use, a situation which further exacerbates the tension between the conservation of urban land resources and development focused on urban expansion and economic growth. Land resources, particularly those in urban areas, are a crucial factor affecting urban, regional, and socioeconomic development[1-2]. Therefore, the Chinese government has focused on devising methods to resolve the conflict and effectively allocate land resources to improve urban functions and guide urban development. Early foreign studies on land use mostly adopted an economics perspective to discuss urban planning and location theories[3]. The concept of performance was introduced to institutional economics after American economist Douglass North stated in his book *Transaction Costs, Institutions, and Economic Performance*, published in the 1990s, that performance is the manifestation of institution[4]. Land use can be viewed as the institutional arrangement of land resources. Because of further exploration of the concept of performance in foreign studies, it has gradually become a common lens through which to address problems related to land resource management and use. Chinese research on theories and methods associated with land use performance had become a rapidly growing field by the end of the twentieth century because of the application of computer science technology to surveys and the evaluation of state-owned land resources. After Dr. Fu Bo-jie's research evaluating tourism and urban land use in the 1980s[5], Chinese scholars began shifting their attention to the evaluation of nonagricultural land use performance. Following the rapid socioeconomic development and urbanization of China, more scholars conducted extensive research on the performance and evaluation of land use[6]. The scope of such research ranged from nationwide[7], provincewide[8], and citywide[9] to development zone–scaled[10] and township-scaled (villages and streets)[11]. Studies have explored topics such as land use sustainability[12-13], urban land supply[14], effective land use and impediments thereof[15], and land development management systems[16] to investigate current land use policy in China and predict future land use trends. Because

of the development of computer science technology, related research methods have become more precise and quantitative. Common methods adopted by land use studies now include the analytic hierarchical process[17], grey relational analysis[18], entropy model[19], and multi-factor comprehensive evaluation[12].

Hechi City is an essential portal to China to members of the Association of Southeast Asian Nations (ASEAN). In addition, it is a typical southwestern Chinese city with karst topography. This signifies that the city mostly consists of mountainous areas, causing problems pertaining to limited useable land, severe soil erosion, and frequent natural disasters. Because of projects related to the Belt and Road Initiative and construction of the Pearl River–West River Economic Belt, Hechi City has undergone rapid population increase due to migration. However, this has also led to increasingly severe regional problems related to the lack of land resources, sparse land utilization, and environmental pollutions. Therefore, using scientific methods for understanding and analyzing data related to urban land use performance is critical for improving the efficient use of land and enabling the sustainable socioeconomic development of a city. This study established an evaluation index system based on four dimensions, namely the land use input level, utilization structure and degree, utilization benefit, and ecological sustainability, and a weighted comprehensive performance index model was adopted to analyze the urban land use performance of Hechi City. The study results can serve as a reference for the optimized allocation and sustainable development of land resources in Hechi City.

Data Sources And Status Of The Research Site

Status Of The Research Site

Hechi City is a prefectural-level city under the jurisdiction of the Guangxi Zhuang Autonomous Region. The city is located on the northwest boundary of Guangxi and approximately at the southern base of the Yunna–Guizhou Plateau (23°41'–25°37'N, 106°34'–109°09'E), and serves as an essential gateway to southwestern China for coastal ports as well as ASEAN member countries. Karst topography accounts for over 60% of the total area of Hechi City and exceeds 2000 km^2; hence, the city consists of the greatest area of karst topography among cities in Guangxi. The topography of Hechi City is diverse, with a complex structure, seamless mountains, and a high amount of soluble rock. The elevation of the city increases from southeast to northwest. The city is mostly mountainous and contains little usable land but abundant mountain streams and rivers, resulting in problems such as rock desertification, soil erosion, and the frequent occurrence of natural disasters[20].

In response to the complex economic situation brought about by China's 12th Five-Year Plan, Hechi City has played a leading role in adapting to China's "New Normal." The gross regional product of Hechi City exceeded the ¥60 billion mark, reaching ¥61.803 billion in 2015, and the per capita gross domestic product (GDP) increased from ¥12991 in 2010 to ¥17810 in 2015. The urbanization rate of Hechi City increased from

27.35% in 2010 to 34.7% in 2015, and the ratio of the tertiary industry increased from 33% in 2010 to 44.9% in 2015. Despite notable development in the overall economy, the city has weak infrastructure development and is constrained by geographical factors. In addition, the Guangxi cadmium spill has had a lingering effect and impeded the development of Hechi City with respect to industrial transformation, resource allocation, and environmental management.

Data Sources

This study targeted Hechi City as the research site. Economic, demographic, land, and environmental data used in this study were mainly obtained from the China City Statistical Yearbook (2010–2015), the Guanxi Statistical Yearbook (2010–2015), the Hechi City Statistical Yearbook (2010–2015), and relevant statistical reports. Some numerical data were calculated according to the aforementioned statistical data.

Research Methods And The Land Use Performance Evaluation Index System

Construction Of The Evaluation Index System

Land use performance is a comprehensive concept that pertains to the objective of realizing a benefit or effect during the process of land resource utilization[15]. Amidst coordinated regional development and the New Normal, the rational use of land resources in western Chinese cities, particularly Hechi City, must entail performance evaluation from multiple perspectives, including benefits, structures, effects, and environment[19]. On the basis of previous research, this study adopted not only economic indexes such as input and benefit, but also soft indexes such as ecological sustainability. According to the application of scientific principles of representativeness and operability for selecting adequate indexes, this study chose 19 indexes from four dimensions, namely land use input level, utilization structure and degree, utilization benefit, and ecological sustainability to construct a land use performance evaluation index system for Hechi City.

Evaluation Methods and Models

Index standardization.

The proposed indexes cannot be compared directly because they differ in units and how they were calculated; hence, these differences must be removed. This study adopted the efficacy coefficient method to categorize the indexes into positive effect and negative effect indexes and standardized the corresponding original data of these indexes [21]:

Positive effect index: $x_{ij} = \frac{x'_{ij} - \min x'_{ij}}{\max x'_{ij} - \min x'_{ij}}$ (1)

Negative effect index: $x_{ij} = \frac{\max x'_{ij} - x'_{ij}}{\max x'_{ij} - \min x'_{ij}}$ (2)

where x_{ij} represents the standardized value of the *i*th index in the *j*th year, x'_{ij} represents the initial value of the *i*th index in the *j*th year, and $\max x'_{ij}$ and $\min x'_{ij}$ represent the upper and lower limits of the initial value of the i*th* index; $i = 1, 2, 3, \ldots, n$ and $j = 1, 2, 3, \ldots, m$.

Calculation of index weights.

To calculate the value of each index, the weight of the index must also be determined. Currently, weight calculation methods adopted by domestic studies are mainly divided into objective and subjective methods. Common objective weighting methods involve calculating the coefficient of variation or entropy value, whereas subjective weighting methods mostly rely on subjective interpretations by individuals through approaches such as the Delphi method. To reduce the effect of subjective factors, improve the objectivity of the calculation model, and ensure that the model concurs with scientific principles, this study employed the coefficient of variation method using the following equations: First, the mean and standard deviation of each index are calculated:

$$\bar{x}_i = \frac{1}{m}\sum_{j=1}^{m} x_{ij} \quad (3)$$

$$S_i = \sqrt{\frac{\sum_{j=1}^{m}(x_{ij}-\bar{x}_i)^2}{m}} \quad (4)$$

where $\bar{x}_i$ represents the mean index valueand S_i represents the standard deviation; $i = 1, 2, 3,\ldots, n$; and $j = 1, 2, 3,\ldots, m$.

Next, the coefficient of variation and weight of each index are calculated:

$$v_i = \frac{\bar{x}_i}{s_i} \quad (5)$$

$$w_i = \frac{v_i}{\sum_{i=1}^{n} v_i} \quad (6)$$

where v_i represents the coefficient of variation and w_i represents the index weight.

Land use performance evaluation model.

The land use performance of Hechi City was evaluated using four dimensions, namely the land use input level, utilization structure and degree, utilization benefit, and ecological sustainability. According to the methods adopted by Chen et al.[20,22], the present study employed a comprehensive index model to determine the comprehensive land use performance using the following equation:

$$M = \sum_{i=1}^{4}(\sum_{i=1}^{m} w_i x_i) \quad (7)$$

where M is the comprehensive performance index of urban land use, w_i is the index weight, and x_i is the standardized index value.

Results and Analysis

Index standardization and weighting

A standardized index matrix (Table 2) was obtained using (1) and (2), and (3)–(6) were used to determine the weight of each index (Table 3) according to the corresponding standardized index value.

The values in Table 4 were calculated using model (7) and then organized into a time-series graph (Figure 1). According to the performance evaluation results, this study further analyzed the land use performance using the time-series data and four dimensions.

Table 1. Index system for evaluating the land use performance of Hechi City

Target	Dimension	Index	Unit
Hechi City land use performance evaluation index system	Land use input level	Mean fixed asset investment per unit of land	¥10000 /km²
		Mean infrastructure investment per unit of land	¥10000 /km²
	Utilization structure and degree	Ratio of residential buildings	%
		Ratio of industrial buildings	%
		Ratio of public infrastructure	%
		Number of workers per unit of land	people/km²
		Road area per person	m²/person
		Construction area per person	m²/person
		Number of public transportation buses per 10000 people	*biao tai* (a standardized vehicle unit)
		Population density	people/km²
	Utilization benefit	Mean annual salary	¥
		Mean retail sales of consumer goods per unit of land	¥10000 /km²
		GDP per unit of land	¥10000 /km²
		Energy consumption per unit of land	10000 kw·km²
		Water consumption per unit of land	10000 m²/km²
	Ecological sustainability	Forest coverage rate	%
		Park and green space area per person	m²
		Decontamination rate of urban refuse	%
		Waste water treatment rate	%

Table 2. Standardized index matrix evaluating the land use performance of Hechi City from 2010 to 2015

Index	Year					
	2010	2011	2012	2013	2014	2015
Mean fixed asset investment per unit of land	0.735 70	1.000 00	0.000 00	0.162 40	0.292 60	0.429 20
Mean infrastructure investment per unit of land	0.488 12	1.000 00	0.179 32	0.000 00	0.060 23	0.325 18
Ratio of residential buildings	0.540 40	1.000 00	0.000 00	0.753 60	0.945 60	0.457 90
Ratio of industrial buildings	0.000 00	0.104 10	0.695 64	0.388 00	0.679 79	1.000 00
Ratio of public infrastructure	0.000 00	1.000 00	0.146 82	0.321 69	0.226 91	0.088 16
Number of workers per unit of land	1.000 00	0.841 15	0.555 78	0.284 26	0.155 31	0.000 00
Road area per person	0.000 00	0.128 83	0.453 99	0.079 75	0.963 19	1.000 00
Construction area per person	0.000 00	0.160 75	0.439 13	0.738 06	0.867 16	1.000 00
Number of public transportation buses per 10000 people	0.000 00	0.524 27	0.815 53	0.543 69	1.000 00	0.271 84
Population density	0.952 33	1.000 00	0.728 25	0.000 00	0.201 81	0.158 66
Mean annual salary	0.000 00	0.185 03	0.18517	0.322 09	0.773 63	1.000 00
Mean retail sales of consumer goods per unit of land	0.000 00	0.39022	0.521 14	0.531 14	0.829 65	1.000 00
GDP per unit of land	0.857 95	1.000 00	0.535 22	0.000 00	0.057 87	0.333 09
Energy consumption per unit of land	0.193 04	0.000 00	0.167 42	1.000 00	0.823 14	0.660 45
Water consumption per unit of land	0.000 00	0.364 28	0.634 99	0.874 02	0.908 26	1.000 00
Forest coverage rate	0.000 00	0.352 27	0.528 41	0.715 91	0.852 27	1.000 00
Park and green space area per person	0.322 34	0.000 00	0.578 75	0.575 09	1.000 00	0.809 52
Decontamination rate of urban refuse	0.000 00	0.475 25	0.992 57	0.733 17	0.985 15	1.000 00
Waste water treatment rate	0.000 00	0.527 09	0.768 47	0.979 31	0.655 17	1.000 00

Table 3. Weights of the Hechi City land use performance indexes

Dimension	Index	Weight
Land use input level	Mean fixed asset investment per unit of land	0.056 59
	Mean infrastructure investment per unit of land	0.071 38
Utilization structure and degree	Ratio of residential buildings	0.039 86
	Ratio of industrial buildings	0.053 30
	Ratio of public infrastructure	0.080 73
	Number of workers per unit of land	0.055 45
	Road area per person	0.068 07
	Construction area per person	0.049 79
	Number of public transportation buses per 10000 people	0.045 49
	Population density	0.057 42
Utilization benefit	Mean annual salary	0.062 83
	Mean retail sales of consumer goods per unit of land	0.042 49
	GDP per unit of land	0.058 78
	Energy consumption per unit of land	0.057 06
	Water consumption per unit of land	0.040 54
Ecological sustainability	Forest coverage rate	0.041 93
	Park and green space area per person	0.042 86
	Decontamination rate of urban refuse	0.038 00
	Waste water treatment rate	0.037 42

Evaluation of Hechi City land Use Performance.

Table 4. Evaluation of Hechi City land use performance from 2010 to 2015

Year	Land use input level	Utilization structure and degree	Utilization benefit	Ecological sustainability	Comprehensive performance
2010	0.076 48	0.153 21	0.061 45	0.013 82	0.304 95
2011	0.127 97	0.270 82	0.101 76	0.052 56	0.553 10
2012	0.012 80	0.211 43	0.100 53	0.113 44	0.438 21
2013	0.009 19	0.159 36	0.135 30	0.119 18	0.423 03
2014	0.020 86	0.266 67	0.171 05	0.140 56	0.599 13
2015	0.047 50	0.218 00	0.203 13	0.152 06	0.620 68

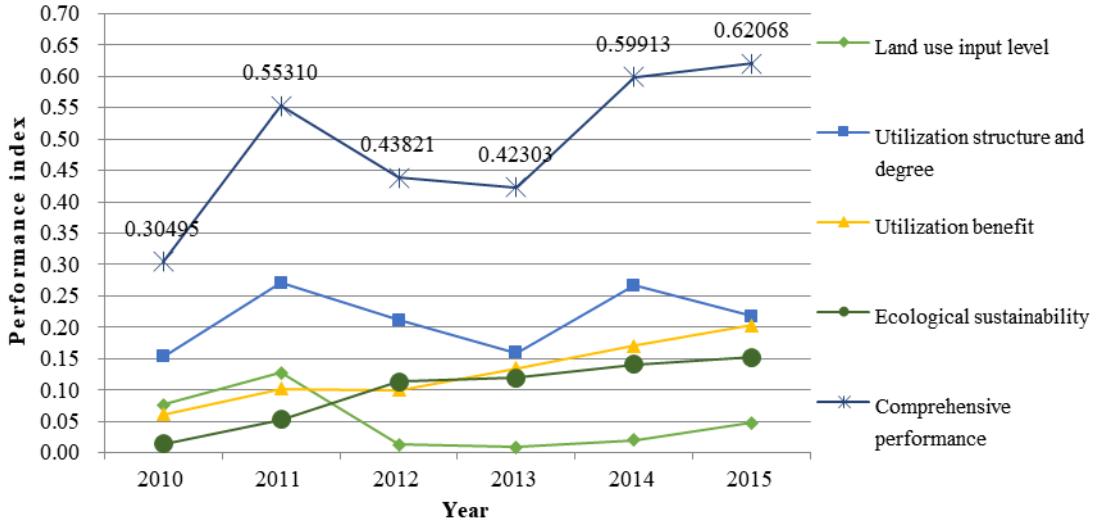

Figure 1. Line graph depicting the land use performance of Hechi City from 2010 to 2015

Time-variant comprehensive performance.

Figure 1 depicts fluctuations in the comprehensive land use performance from 2010 to 2015. The overall performance increased, but the extent of increase was small. The comprehensive index increased from 0.30495 in 2010 to 0.62068 in 2015, indicating that during the implementation of the 12th Five-Year Plan, the comprehensive land use performance of Hechi City was improved through adjustment measures. The period between 2010 and 2011 marked a turning point where the 11th Five-Year Plan was concluded and the 12th Five-Year Plan was initiated. During this period, Hechi City was subject to strict management that focused on the integration of state-owned land resources. Accordingly, the city demonstrated notable improvement in utilization structure, degree, and benefit. From 2012 to 2013, the needs for land and mineral resources increased with the rapid industrialization and urbanization of the city, resulting in considerable pressure on the management of stated-owned land resources. In 2013, the population density of Hechi City peaked at 148.7 people/km^2, which caused the utilization structure and degree index to decrease noticeably. Consequently, the comprehensive performance index in 2013 also decreased compared with that in 2011. Under the implementation of the 12th Five-Year Plan for managing stated-owned land in Guangxi between 2014 and 2015, Hechi City applied informatization methods to the management of stated-owned land. Management plans were formulated before related tasks were executed through scientific approaches. The proportions of land used for residential, industrial, and public infrastructure stabilized, and improvement was observed in the mean retail sales of consumer goods per unit of land, mean GDP per unit of land, and forest coverage rate. In addition, index values in the land use input level, utilization rate, and ecological sustainability dimensions increased compared with those between 2012 and 2013.

Performance analysis of individual dimensions.

(1) Land use input level

The land use input level of Hechi City increased substantially between 2010 and 2011. Specifically, this index peaked at 2011, exceeding 0.1. However, between 2012 and 2015, the index drastically decreased to 0.02086 in the first two years and then gradually but slightly increased in the next two years, reaching 0.04750 in 2015. This indicated that the city's overall land use input level was unfavorable during the study period. In 2011, Hechi City implemented a measure to increase the land used for urban construction by reducing the land used for rural construction. By reducing the construction costs and controlling internal expenses, the city expanded the land available for construction, and the mean fixed asset investment per unit of land and mean infrastructure investment per unit of land reached ¥2639491217/km^2 and ¥105814658/km^2, respectively. These two values peaked between 2010 and 2011. However, with the implementation of the 12th Five-Year Plan in December 2011, protection and conservation of stated-owned land resources became the focus of land management measures. Consequently, Hechi City reduced its land use input level. Overall, the land use input level between 2012 and 2015 was low and with a slight increasing trend.

(2) Utilization structure and degree

Fluctuations were observed in the utilization structure and degree index between 2010 and 2015 (Figure 1). However, the comprehensive performance index was higher during the implementation of the 12th Five-Year Plan compared with that in 2010. Specifically, the comprehensive performance index increased from 0.15321 in 2010 to 0.21800 in 2015 (Table 4), indicating improvement in the land utilization structure and degree. The year 2011 marked the beginning of the 12th Five-Year Plan, during which Hechi City actively promoted development projects in various fields. Therefore, the utilization structure and degree index peaked in 2011, reaching 0.27082. Subsequently, the index fluctuated between 2012 and 2015 and decreased to 0.15936 in 2013. This decrease was mainly attributable to other indexes such as the mean road area per person, number of public transportation buses per 10000 people, and population density. Specifically, the mean road area per person and number of public transportation buses per 10000 people in 2013 were only 4.80 m^2/person and 4.57 *bio tai*, respectively. This indicated that during this period, the pressure incurred by the substantial population increase led to an irrational land utilization structure; hence, the land utilization degree, overall performance, and corresponding indexes were low. During the later stage of the 12th Five-Year Plan, Hechi City gradually adjusted the proportions of land used for industrial, residential, and infrastructure. Rational measures were implemented to improve land allocation and utilization structure. Accordingly, the land use performance was enhanced.

(3) Utilization benefit

The overall utilization benefit index of Hechi City improved steadily from 0.06145 in 2010 to 0.20313 in 2015. The incremental rate was higher

between 2013 and 2015. Observing individual indexes revealed that the mean annual salary increased from ¥27523.01 in 2010 to ¥40380.45 in 2015. The mean retail sales of consumer goods per unit of land increased from ¥852621400/km^2 in 2010 to ¥1070272600/km^2 in 2015, and the extent of increase was particularly notable during the implementation of the 12th Five-Year Plan. This indicated substantial improvement in residents' salaries and consumption, and the land utilization benefit was higher in the social and economic dimensions. Since 2013, Hechi City has put solid efforts into land consolidation, reclamation, and remediation. In 2013 alone, the Department of Land and Resources of Guangxi Zhuang Autonomous Region verified that Hechi City had reclaimed 5786.9744 Ha of arable land, which can be used as reserve land for the Requisition Compensation Policy that requires the local government to reclaim the same amount of arable land as that permitted for development. The mean GDP per unit of land also increased steadily after 2013, indicating the adequate use of land resources in the later stage of the 12th Five-Year Plan has generated increasing economic benefits.

(4) Ecological sustainability

The ecological sustainability index of Hechi City increased continually from 0.01377 in 2010 to 0.15160 in 2015. The greatest increase occurred between 2010 and 2012, whereas the increase between 2013 and 2015 was relatively small but stable. Observing individual indexes revealed that the forest coverage rate increased gradually each year. Despite fluctuations, the mean park and green space area per person also increased, peaking at 10 m^2 in 2014. The decontamination rate of urban refuse and waste water treatment rate also increased. Specifically, the decontamination rate of urban refuse increased from 56% in 2010 to 96% in 2015 for an increase of 40%. The waste water treatment rate increased from 69% in 2010 to 89% in 2015 for an increase of 30%. This indicated that in the domain of socioeconomic development, the city increased its emphasis on the construction of environmental and ecological infrastructure. Under the guidelines of the 12th Five-Year Plan for managing state-owned land in Guangxi, Hechi City has actively promoted compulsory environmental mechanisms while maintaining the progress of industrial transformation and upgrades since 2012. The city government has not only initiated construction projects for parks and green space to improve the city's ecological infrastructure but also endeavored to improve refuse decontamination and waste water treatment as well as accelerate the establishment of an environmentally friendly society through material cycle and waste management. Accordingly, the ecological sustainability of land resources in Hechi City has continually improved.

Conclusion and Suggestions

This study targeted Hechi City, located in western China, to establish an index system and evaluate the land use performance of the city. The performance evaluation was conducted using time-series data and four dimensions. The results revealed that despite several fluctuations, the comprehensive land use performance index of Hechi City increased from 0.30495 in 2010 to 0.62068 in 2015, with a mean

annual increase rate of 12.57%. The extent of improvement was particularly notable in the later stage of the 12th Five-Year Plan. Regarding the four dimensions, this study found that the land utilization benefit and ecological sustainability improved annually, whereas the land use input level remained low throughout the study period but exhibited a small increase during the implementation of the 12th Five-Year Plan. Variances were observed between the dimensions. Although the utilization structure and degree index was higher in the later study period than in the early study period, fluctuations were observed throughout the entire study period and exerted a substantial effect on the comprehensive performance of the city. In the future, Hechi City should focus on optimizing its land utilization structure to improve land use efficiency.

From 2010 to 2015, the comprehensive performance index exhibited an increasing trend despite several fluctuations. The utilization benefit and ecological sustainability indexes increased steadily each year, and the land use input level also demonstrated a slight but stable increase throughout the study period. Large fluctuations were observed in the utilization structure and degree index, which exerted a notable effect on the comprehensive performance index. Therefore, subsequent urban development should focus on optimizing the city's land utilization structure to improve its land use efficiency. According to the aforementioned results, this study recommends four land use policies that can serve as a reference for Hechi City to overcome its geographical constraints and improve its land allocation and land resource utilization.

(1) Strengthen the guiding function of urban planning, and emphasize the implementation and execution of policies related to the planning and utilization of urban land.

In novel approaches to urbanization, development is the goal and planning is the "beginning." Urban planning must entail thorough consideration of the relationships between overall planning, regional planning, and utilization planning of urban land. Urban space expansion and land resource allocation are based on land utilization planning. Therefore, the feasibility and rationality of such planning are crucial to such urban planning. To further improve its land use efficiency, Hechi City should improve construction planning, optimize the land utilization structure, rationally resolve problems concerning land use inputs and outputs, and promote balanced and coordinated development in the social, economic, and environmental dimensions.

(2) Improve urban land management systems, adjust the land utilization structure, and improve the land utilization rate.

Fluctuations were observed in the utilization structure and degree index, which decreased in several years during the study period. Currently, Hechi City suffers from an irrational utilization structure and a low degree and efficiency of utilization. Therefore, the city government should enhance the execution of land management measures and ensure rigorous implementation of related standards, and relevant authorities should fulfill their duties in land use management. Moreover, the government can adopt economic, administrative, and legal approaches to

perfect the land market system and improve land regulation and management services, thereby promoting a rational utilization structure and enhancing land use efficiency.

(3) Accelerate industrial transformation and improve the quality and efficiency of land utilization: Bolster Hechi City's status as an essential portal to ASEAN member countries.

Hechi City should participate in other regional development programs and capitalize on the development opportunities brought about by the Belt and Road Initiative, the China Western Development Program, the revitalization project for the revolutionary base area in the Zuo Jiang and You Jian region, and the Pearl River–West River Economic Belt construction project. Motivated by "Big Tourism," the government should transform Hechi City into an international tourism spot. In addition, the city should leverage its resource advantages to establish new industrial zones, thereby driving economic development through innovation. This can also facilitate ecology-based industrial development and construction of ecological infrastructure. In addition, the government should reduce the contribution of real estate finance to economic development by coordinating the relationship of the real estate industry with other industries, promoting ecology-based industrial development, improving the financial return per unit of land through implementation of scientific methods, and encouraging the optimization and upgrade of industrial facilities. Accordingly, the land use efficiency of the city can be improved.

(4) Promote green economic development and emphasize sustainability in urban land utilization.

During the process of urban space expansion, the urban planning and land utilization of Hechi City must account for the fragility of the environment and adopt ecological preservation schemes, thereby establishing a comprehensive policy system for protecting the environment. Under the principle of respect for nature, the city should promote green economic development and implement compulsory environmental mechanisms, thereby enhancing environmental monitoring to combat illegal waste disposal and inadequate waste treatment. In addition to actively constructing natural disaster prevention infrastructure and critical river and stream preservation facilities, Hechi City should promote novel ecological industries, transform energy-dependent industries, develop ecological tourism, advocate green industrial transformation, develop circular economies, and emphasize sustainability in land resource utilization, thereby establishing an energy-saving and environmentally friendly city.

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